a hybrid. Grouse vary considerably in their colouring from very dark to cream-colour. I do not personally contend that this bird is a hybrid; in my opinion it is a Grouse, and I show it this evening as a curious variety of the colouring of the ordinary Red Grouse."

Other zoologists present confirmed Dr. Hammond Smith's opinion that the bird was not a hybrid.

Mr. D. Seth-Smith, F.Z.S., Curator of Birds, exhibited some skins of the Australian Yellow-rumped Finch (*Munia flaviprymna*). These birds had been kept alive in an outdoor aviary in England, and had developed certain markings tending towards those of another closely allied species, *Munia castaneithorax*. The exhibitor attributed this to the fact that the former species was a desert form of the latter, and when placed in a humid environment tended to revert to the plumage of the latter. He referred to a paper he had published on this subject in the 'Avicultural Magazine,' 1907, p. 195.

Dr. W. E. Hoyle, M.A., F.Z.S., English Member of the International Commission on Zoological Nomenclature, explained the Report presented to the Graz Meeting of the International Zoological Congress, and referred in particular to the proposals made for the protection of well known zoological names.

A discussion followed on the portion relating to the formation of an Official List of most frequently used Zoological Names. The feeling of the Meeting was very strongly in favour of the International Congress giving its authority to the forming of a List of Zoological Names, the significance of which should not be altered by application of the rules of the International Code. It was unanimously agreed to accept the action of the Congress if it would adopt this course.

PAPERS.

8. On the Segmentation of the Occipital Region of the Head in the Batrachia Urodela.

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(Text-figures 29–51.)

Introduction.

It is now well known that in the Craniata Gnathostomata the region of the head lying behind the auditory capsule is a compound structure, formed of a number of segments originally like those of the trunk. A process of cephalisation leads to the fusion and partial suppression of a number of skeletal segments, or scleromeres, which combine into a compact occipital region continuous with the remainder of the skull in front. Through its wall issue segmental nerves. At the same time, there is a tendency for the corresponding muscular segments to become reduced. The history of this subject has been so often told that it need not be repeated here (Sewertzoff 9, Gaupp 3, and myself 6).

The occipital region in the Amniota has been found to include behind the vagus nerve four scleromeres enclosing three roots of the hypoglossus nerve. There are therefore probably at least five segments altogether between the auditory capsule and the atlas—the first corresponding to the glossopharyngeal, the next to the vagus, and the last three to the hypoglossal. Possibly there are a few more.

In the Pisces the posterior limit of the head is both less definite and more variable in position; but the postauditory region probably always includes at least seven segments. The Selachians have been most thoroughly studied, and in them there are about eight segments behind the auditory capsule (metaotic segments). The first corresponds to the glossopharyngeal nerve and the fourth mesoblastic somite (three of these being proötic); the next four segments belong to the vagus, and the last three to the hypoglossus, much as in Amniotes. But in the Selachian the anterior sclerotomes and myotomes are more distinct. The first metaotic somite produces no myotome, and therefore preserves no ventral nerve-root. The remaining occipital somites contribute to the hypoglossal musculature, and their corresponding ventral roots are the spino-occipitals of Fürbinger (*s*—*z*). But the muscles of these segments tend to disappear in ontogeny from before backwards. In adult Selachians some two or three hypoglossal roots are usually found piercing the occipital region of the skull. An examination of the early stages, however, reveals the complete series of somites, nerves, and skeletal segments, which make up the postauditory region of the head.

Very different is the state of things in the Batrachia (Amphibia). Here the skull appears to end immediately behind the vagus foramen; and nerves contributing to the hypoglossal issue from the vertebral column behind the occipital condyles.

The first, second, and third spinal nerves may form the complex hypoglossal; the second being the main, and often the only, hypoglossal nerve in the adult.

These facts immediately suggest several questions:—Does the occipital region of the Amphibian really include fewer segments than that of the other Gnathostomes, or have certain segments been telescoped and practically crushed out? Are the hypoglossal segments of the Gnathostomes really represented by the first three trunk-segments of the Amphibian, or have these simply assumed the function originally fulfilled by others farther forward?

Further, if the Amphibian head includes fewer segments, it may be asked whether this condition is primary, or due to the return of segments to the trunk which formerly held a place in the head.

It is essential before attempting to answer these questions to determine how many head-segments can actually be traced in ontogeny. Other observers have attacked the problem, but their results are not in agreement. With a view to settling this point I undertook the study of the development of the head-region in the Axolotl (*Amblystoma tigrinum*).

My method has been to reconstruct series of sections on paper. For this purpose it is important to have a very complete set of stages cut in various directions. I have to thank Dr. J. W. Jenkinson for the loan of a large number of excellent series of sections filling up the gaps in my own preparations. An appropriate number of stages has been selected for representation in the figures given in the text; but it will be understood that intermediate stages have been examined. Of these figures, nos. 33–38, 40–43, and 45–49 were drawn from Mr. Jenkinson's series.

Description.

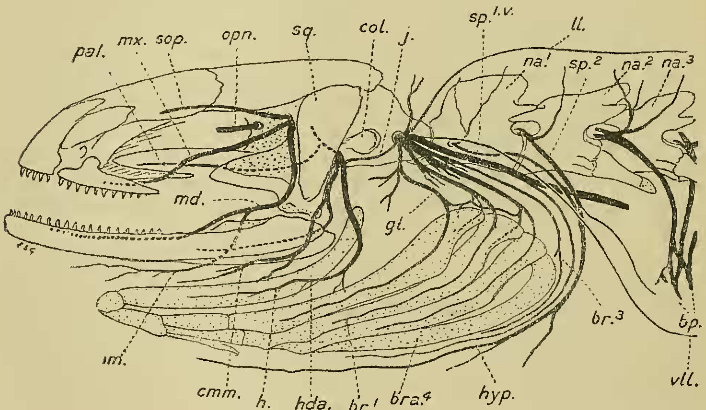
Before describing my own observations it will be well to give a brief account of the results obtained by previous workers. A good general description of the development of the skull of the Axolotl has been given by Parker (**7**). He describes the basilar plate, or floor of the cranium behind the pituitary fossa, as formed of a parachordal extension of the trabecular bars, combined with "proper occipital parachordals behind." The latter give rise to the occipital condyles; but their exact relation to the myotomes is not elucidated, although Parker notices that the glossopharyngeal ganglion lies behind the auditory capsule between the first and second myotomes. Stöhr (**11**) has given a very similar account of the development of the skull of *Siredon* (*Amblystoma*). Like Parker he found that the postpituitary region of the skull develops from three separate sources: the anterior parachordals ("Balkenplatten") derived from the trabeculæ, the auditory capsules, and the occipital arches. By means of reconstructions of sections he made out clearly the origin of the posterior occipital arch. These arches, compared to vertebral arches, grow over the brain above, and along the sides of the notochord (occipital parachordals of Parker) join the backward extensions of the trabeculæ ("Balkenplatten"), and enveloping the notochord form the basilar plate, which subsequently fuses with the auditory capsules. Stöhr, however, did not make out the exact position of the occipital element with regard to the nerves and myotomes.

Sewertzoff (**9**) was the first author to attack this problem directly. According to his account there are two metaotic somites, giving rise to two myotomes in the embryo (text-fig. 50, B, p. 116). The 1st disappears later. The 2nd, corresponding to the vagus, remains. Behind it, in the septum between the 2nd and 3rd, develops the occipital arch. The first trunk-segment

(3rd metaotic) has a myotome, a ventral root, but no ganglion. The next and succeeding trunk-segments are complete. That this description is incorrect has already been suggested by Miss Platt, who has given us a detailed and admirable account of the development of the head in *Necturus* (8).

Miss Platt analyses the postauditory region as follows:—The 1st somite belongs to the glossopharyngeal segment, develops no myotome and has no ventral root. The 2nd, 3rd, and 4th are vagus segments; the 2nd somite disappears ventrally, but its dorsal portion develops muscle which combines with the more fully formed myotome of the 3rd somite. The 4th and succeeding somites develop myotomes. The 3rd, 4th, and 5th grow down ventrally to give rise to the hypoglossal muscles, supplied by the ventral roots of the 4th and 5th segments. The 6th segment (3rd of the trunk) is the first to have a complete spinal nerve with ganglion, ventral and dorsal root. The first neural arch lies between the 4th and 5th somites. Between the 4th and 3rd somites appears the occipital arch marking the hind limit of the skull; while between the 3rd and 2nd somites is formed a rudimentary præoccipital arch, which is taken into the auditory capsule. If this account is correct, there are three metaotic segments in the head of Amphibia, the myotomes of the last two being represented in the adult by the anterior region of the dorsal temporal muscle.

Text-fig. 29.



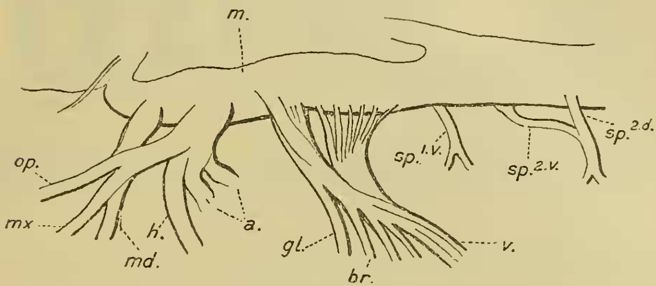
Dissection of a full-grown Axolotl, showing the skeleton and nerves of the head and three trunk-segments. The cartilage is dotted. View from left side.

Coming now to my own observations on *Amblystoma*, we may begin with a glance at the structure of the full-grown animal as shown in text-figs. 29 and 30 *. The hyomandibular branch of the facial nerve issues from behind the otic process of the quadrate

* For explanation of the lettering of these text-figures see p. 120.

and the overlying squamosal, and passes down the hyoid arch. The glossopharyngeal and vagus come out together behind the auditory capsule—the former supplying the first branchial arch, and the latter giving off three branches to the remaining arches. A large visceral branch of the vagus runs along the alimentary canal, a

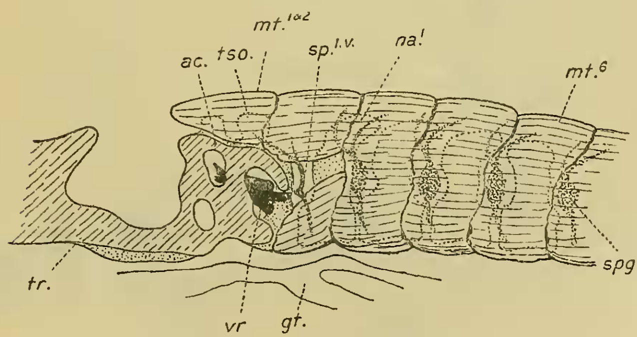
Text-fig. 30.



Outline of spinal cord and hind brain, with roots of cranial nerves and first two spinal nerves, seen from left side.

dorsal branch upwards, and slender lateral line branches to the skin. Through the bony neural arch of the first vertebra issues the first spinal nerve, having a ventral root only. Passing over the vagus it soon joins the complete second spinal, which has two roots *, and comes out behind the first vertebra. A dorsal twig of the first spinal supplies the temporal muscle. The first and second spinals together make up the hypoglossal nerve.

Text-fig. 31.

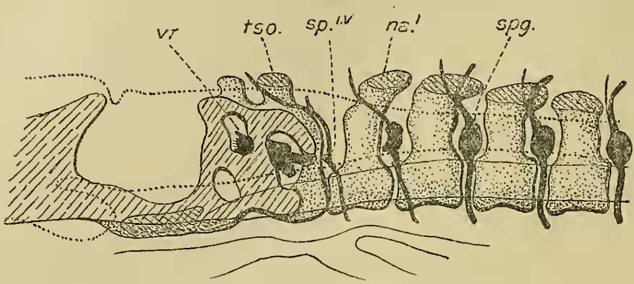


Partial reconstruction of the hind region of the skull and the anterior region of the trunk of an advanced larva with a head 6 mm. long. The cartilaginous skeleton and nerves are shown through the myotomes.

Text-figs. 31 and 32 are partial reconstructions of a larva which has nearly acquired the structure of the fully grown animal. The auditory capsule is chondrified and fused to the basilar plate,

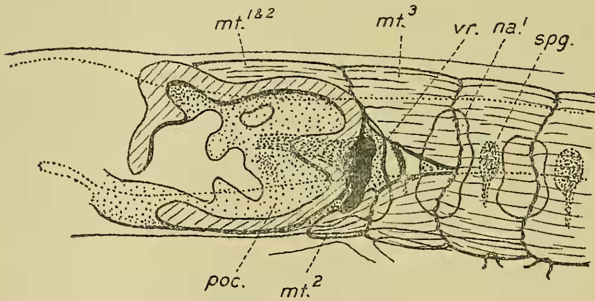
* Miss Platt finds only a ventral root to this nerve in *Necturus*. There can be no doubt that both roots are present in *Amblystoma* as well as a ganglion.

Text-fig. 32.

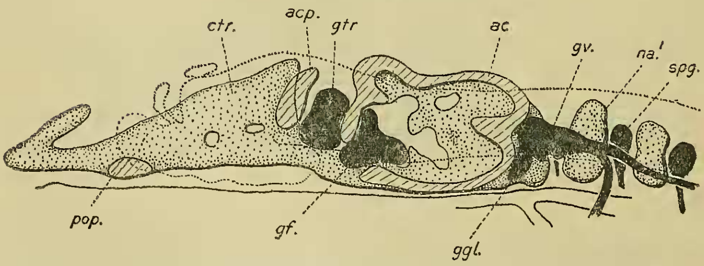


Partial reconstruction of the hind region of the skull and the anterior region of the trunk of the advanced larva shown in text-fig. 31. The myotomes have been removed.

Text-fig. 33.



Text-fig. 34.

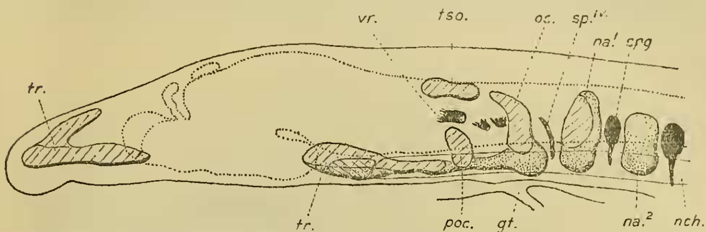


Partial reconstructions of the left side of the head region of a younger larva, in which a large amount of cartilage is developed.

Text-fig. 33 shows the inner wall of the auditory capsule, and the anterior myotomes of the trunk through which are seen portions of the skeleton and spinal nerves. The vagus nerves have been cut short at their exit from the skull. In text-fig. 34 the skeleton and nerves are more completely shown, but the muscles have been removed.

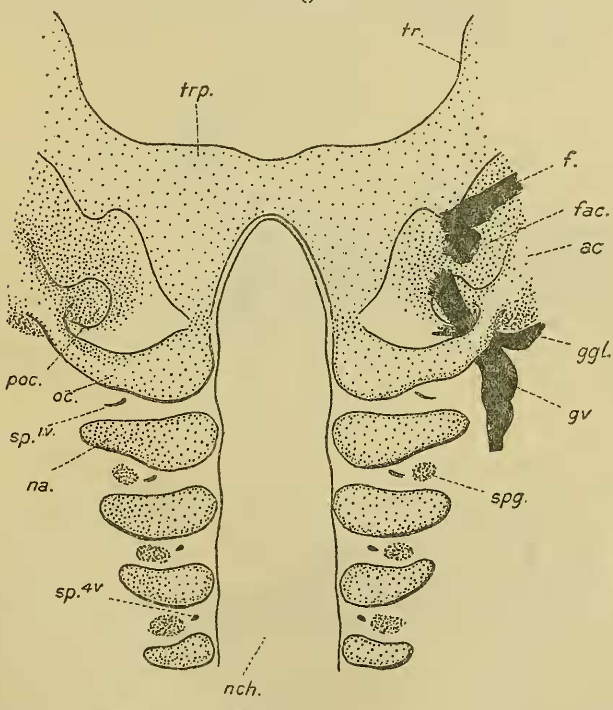
and the præoccipital and occipital arches. The latter is complete above the brain. The second muscular segment, really the third myotome developed in the 4th somite, is split in two by the vagus. The first hypoglossal nerve comes out between the skull and the first neural arch.

Text-fig. 35.



Partial reconstruction of the left side of the head region of the larva shown in text-fig. 34. Represents the same structures cut back to nearer the middle line, the auditory capsule and side wall of the skull being removed and the vagus roots exposed.

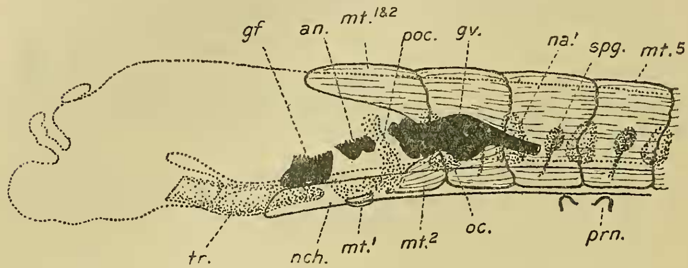
Text-fig. 36.



Reconstruction, seen from above, of the hind region of the skull, and anterior neural arches. Some roots of cranial nerves are seen on the right.

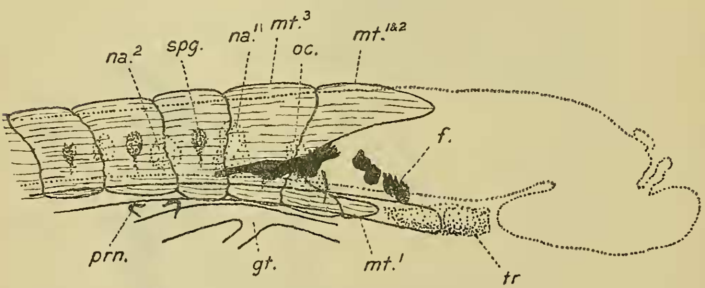
A larva slightly younger is shown in text-figs. 33, 34, and 35. At this stage the ventral portion of the 2nd myotome is still preserved. It lies below the vagus between the occipital and the præoccipital arches. The latter is seen to be a thickening in the inner wall of the auditory capsule, continuous below with the basilar plate (text-fig. 35). A reconstruction of a rather earlier stage seen from above (text-fig. 36) shows the capsule beginning

Text-fig. 37.

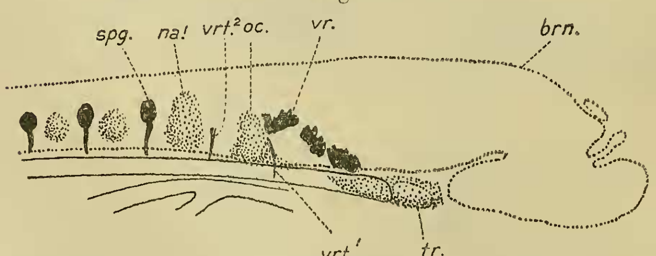


Left side view of a partial reconstruction of the anterior end. Cartilage is beginning to appear. The trabeculæ have been cut short. The pronephric funnels are indicated in metaotic segments 5 and 6. The ventral portion of myotome 1 is still present.

Text fig. 38.



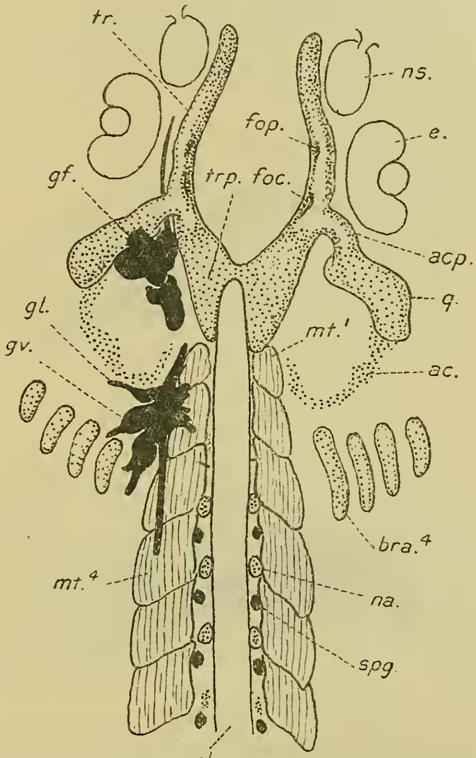
Text-fig. 39.



Partial reconstructions seen from the right side. In text-fig. 38 are the myotomes and pronephric funnels. The trabeculæ have been cut short.

to chondrify behind; the occipital arch is fused on above the vagus. The floor of the skull widens out considerably from the occipital segment forwards to allow space for the brain, and the præoccipital arch is placed opposite the point where the occipital parachordal plate meets the anterior parachordal plate, a point not yet chondrified. Although it appears to chondrify in continuity with the auditory capsule, the præoccipital arch is probably serially homologous with the neural arches, as already suggested by Miss Platt.

Text-fig. 40.



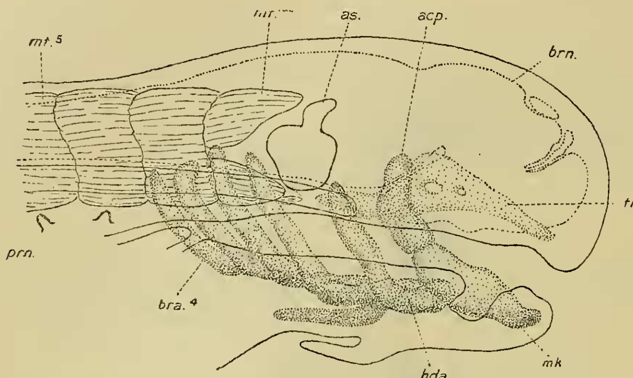
Reconstruction, seen from above, of the head and anterior trunk-region. The dorsal ends of the gill-arches are shown, also the ventral region of the myotomes. Cranial nerve-roots are indicated on the right side.

Its first appearance as a procartilaginous rudiment is seen in text-fig. 37, taken from a still younger larva, in the septum between the 2nd and 1st myotomes. At this stage the ventral portion of the first myotome (2nd somite) is still present. The auditory capsule itself is scarcely recognisable and quite without cartilage.

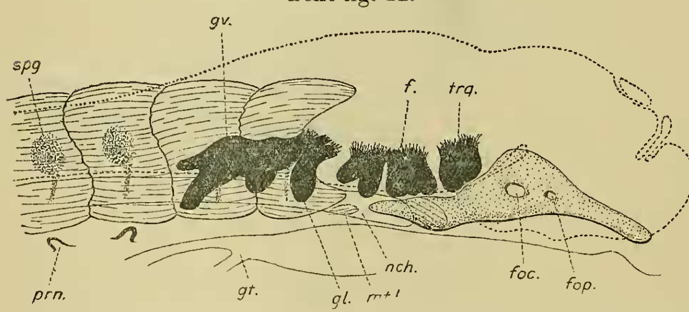
In the next younger stage, text-figs. 38 and 39, the præoccipital arch has not appeared, the ventral portion of the first myotome is larger, a ventral nerve-root is seen supplying myotome 2, and the neural arches are mostly in a procartilaginous state.

Text-fig. 40 is a partial reconstruction of another larva of about the same stage, but rather younger. The ventral portions of myotomes 1 to 6 are shown, also the spinal ganglia. Procartilage vaguely indicates the position of the auditory capsule, the occipital arch is scarcely yet marked out, but the next three neural arches

Text-fig. 41.



Text-fig. 42.

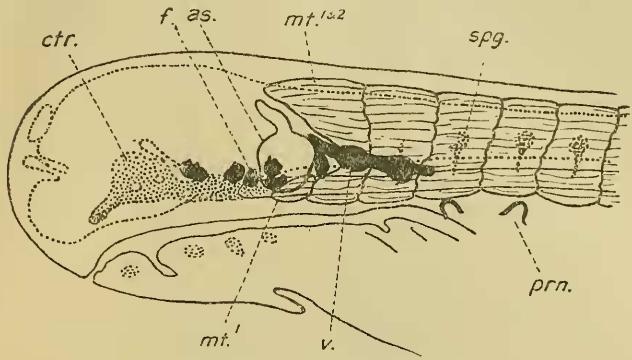


Reconstructions of the anterior region, seen from the right side. The visceral arches and auditory sac are seen in text-fig. 41 ; these have been removed in text-fig. 42, where the nerves are shown.

have begun to develop cartilage. The first myotome is quite, and the second myotome nearly, cut into a dorsal and a ventral portion by the roots of the glossopharyngeal and vagus. The ventral remnant of the first myotome (2nd somite) varies considerably in development, for in the younger larva drawn in text-figs. 41 and 42 it is hardly distinguishable. At this stage the trabeculæ and visceral arches are the only skeletal elements visible, and true cartilage can scarcely be said to have appeared.

The next younger stage (text-fig. 43), again, shows a large ventral piece of the first myotome. At a still younger stage

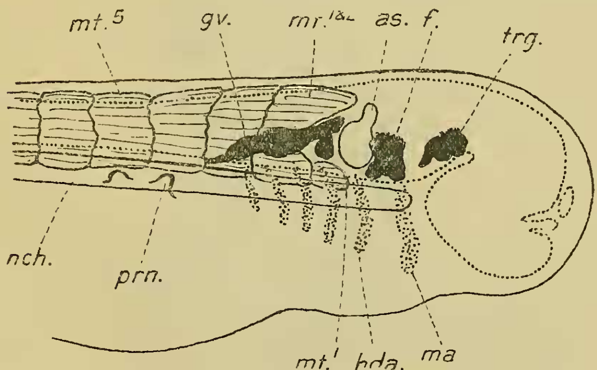
Text-fig. 43.



Left side view of a reconstruction of the anterior region.
The visceral arches are not completed.

(text-fig. 44), the trabeculæ have not appeared and the visceral arches are represented by mere rods of procartilage.

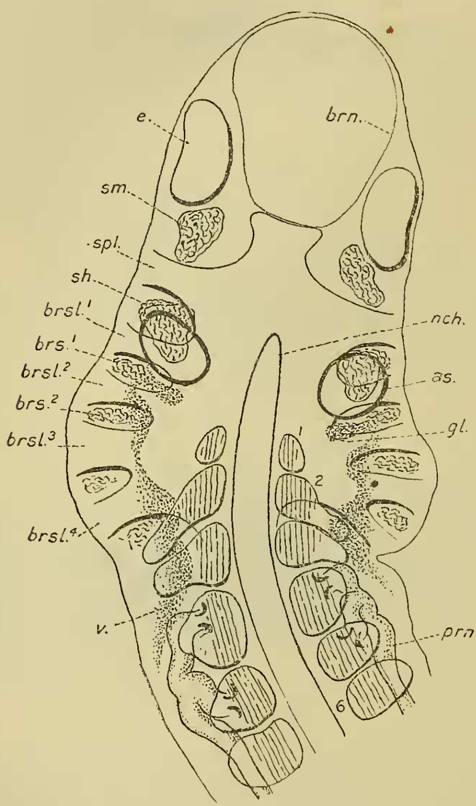
Text-fig. 44.



Right side view of a reconstruction of the anterior end of a larva in which the mesoblastic skeleton is represented only by procartilaginous rod-like visceral arches.

We now come to embryos without true mesoblastic skeleton. These earlier stages are most important in determining the number of postauditory segments. Text-figs. 45 and 46 are reconstructed from an embryo 5 mm. in length; they both are views from above, but text-fig. 46 reaches farther down, so as to include the alimentary canal and optic vesicles. Myotomes 4 and 5 are clearly seen corresponding to the two pronephric funnels. Myotomes 2 and 3 give off diverticula passing behind the 4th branchial slit to form hypoglossal muscles. The ventral portion of the first myotome is some way behind the auditory vesicle and the rudiment of the hypoglossal ganglion. Below and in front of the vesicle is the hyoidean somite; while in front of the rudimentary spiracular gill-slit lies the mandibular somite.

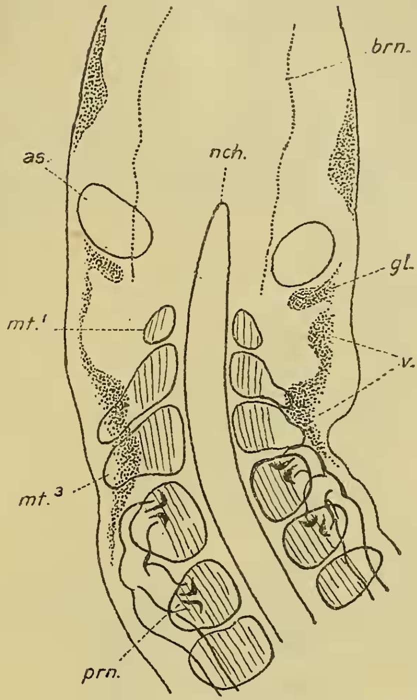
Text-fig. 45.



Partial reconstruction, seen from above, of the anterior region of an embryo in which the mesoblastic skeleton has not yet appeared. The epidermal thickenings corresponding to the glossopharyngeal and vagus nerves are indicated by dots.

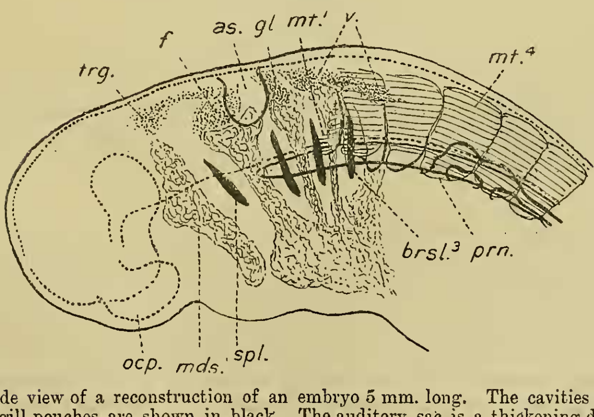
Another embryo of about the same length, but a little younger, is shown from the side in text-fig. 47. Here the auditory vesicle is still quite continuous with the epidermis, and the relation of the somites to the gill-slits is well shown. The slits are represented

Text-fig. 46.



Similar reconstruction of the more dorsal region of the same embryo as in text-fig. 45.

Text-fig. 47.

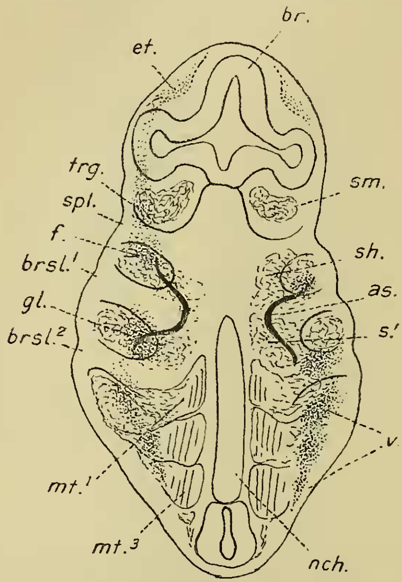


Left side view of a reconstruction of an embryo 5 mm. long. The cavities of the gill-pouches are shown in black. The auditory sac is a thickening directly continuous with the epiblast. Dots indicate epidermal thickenings.

in black, though not yet open. In front is seen the mandibular somite, below the rudiment of the trigeminal ganglion. Behind it lies the hyoidean somite, just in front of the vesicle and below the facial rudiment. Posterior to the vesicle is the glossopharyngeal rudiment, below which extends the first metaotic somite passing downwards into the first branchial arch. The vagus rudiment extends over the next two and part of the 4th somite; the first myotome is placed over the 2nd branchial arch.

Text-fig. 48 is a plan of a young embryo 3 mm. long, seen from the dorsal aspect, the nervous system being partly removed. The

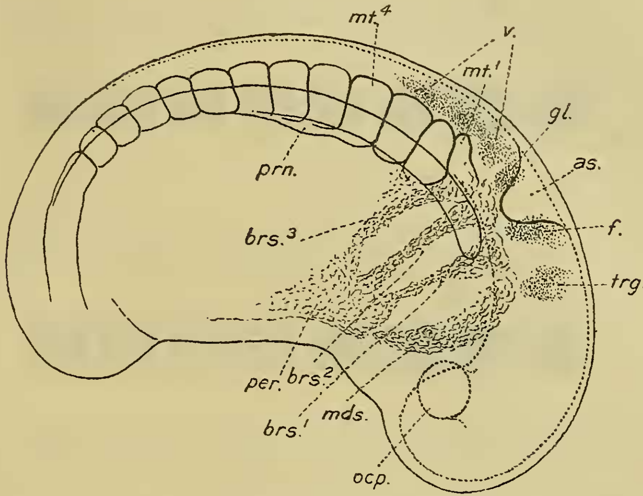
Text-fig. 48.



Partial reconstruction of the anterior region of an embryo 3 mm. long, seen from above. The greater part of the central nervous system has been removed to expose the alimentary canal, notochord, &c. The first and second metaotic somites overlie the first and second gill-arches.

position of the somite with relation to the other structures is much the same as in text-fig. 47. Lastly, in text-fig. 49 is drawn the youngest stage we need investigate. The dorsal portion of the 2nd postauditory somite has become closely pressed on to the 3rd somite, with which it remains intimately associated. Indeed, in the latter stages it is seen to be indistinguishably fused with it, the two combining to form the anterior region of that dorsal muscle which in combination with the 3rd myotome makes up the temporal muscle of the adult. Neither at this nor at any other stage does the first metaotic somite produce muscle-substance.

Text-fig. 49.

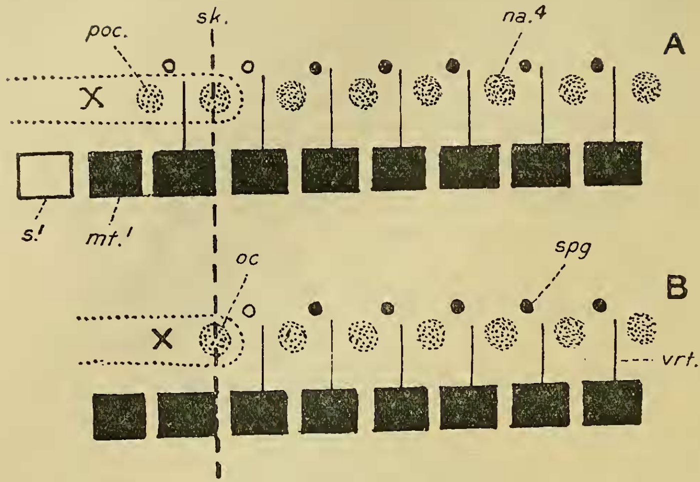


Right side view of a reconstruction of an embryo 3 mm. long. The first metaotic somite appears below the developing auditory sac and the glossopharyngeal epidermal thickening. The 2nd somite is closely applied to the 3rd.

Conclusions.

From the foregoing account it will be understood that in almost every particular my observations confirm the conclusion reached by Miss Platt in her study of *Necturus*. In *Amblystoma* as in *Necturus* there are three occipital segments. The first metaotic somite, however, disappears very early. Probably the examination of an insufficiently complete series of stages misled Sewertzoff (9) into the belief that there are only two metaotic somites; the first being either missed or later confused with the second. Gaupp, in his excellent review of the development of the skull (3), seems rather to favour Sewertzoff's interpretation. But if the diagram given by the latter, and reproduced by Gaupp, were correct, the second and third branchial rami of the vagus would lie outside the head area in the first two trunk-segments; and the third branchial ramus, passing behind the last gill-slit, would then belong to the second trunk-segment already provided with a complete spinal nerve possessing two roots and a ganglion. This is obviously not the case. The results of Sewertzoff and myself are compared in text-fig. 50. Only in unimportant details do my own observations differ from Miss Platt's. For instance, I find a ventral nerve-root in segment 3 and a dorsal root in segment 5. Moreover, the ganglion

Text-fig. 50.



Diagrams of the segmentation of the metaotic region in Amphibia: B according to Sewertzoff, A according to my own observations.

of segment 4 seems to be early included in the rudiment of the vagus ganglia. Finally, text-fig. 51 represents what I believe to be the true composition of the Amphibian head.

Text-fig. 51.

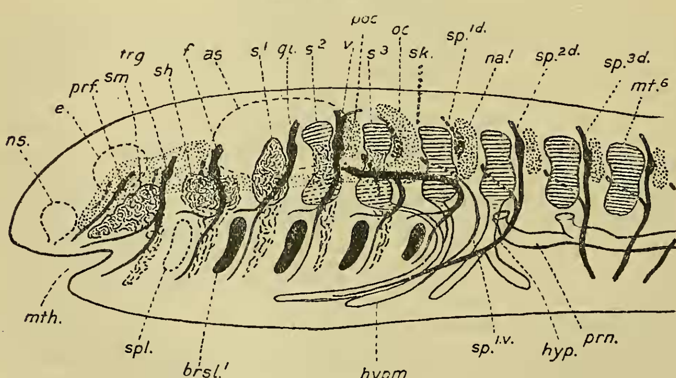


Diagram of the segmentation of the anterior region of an Amphibian.

We may now turn to the questions suggested on page 102. If any segments have been suppressed, it is apparently behind the vagus-root that they have been crushed out. Gegenbaur (4) believed the occipital arch to be a compound of several skeletal segments, not the homologue of a single neural arch as Stöhr supposed. Fürbringer adopts much the same view in his great monograph (2), concluding that the occipital condyle of the Amphibia occupies the same segmental position as the last occipital segment in the Selachii. Many segments are supposed to have been crushed out between this and the vagus corresponding to the region in the Selachian skull through which pass the spino-occipital nerves. He claims, indeed, to have found possible traces of these segments in *Cryptobranchus*, where he discovered a small ventral nerve-root (*z.*) piercing the occipital bone. Miss Platt and Gaupp (8 and 3) are inclined to accept Fürbringer's view. Now the adoption by so many anatomists of the theory that a number of segments have vanished from the Amphibian head by a process of excalation is, I venture to think, based not so much on facts as on theoretical considerations. In the first place, there is a reluctance to admit that a structure like the occipital condyle can be homologous in two groups, although developed in different segments. But there can be no doubt that the homology of an organ is independent of its position in the segmental series.

The hind limbs of a Frog, an Axolotl, and an Amphiuma are homologous, in spite of the fact that they are placed in different segments. It is unnecessary here to recapitulate in full arguments which have already been given at length elsewhere (5, 6) with regard to the development of the fins of fishes. But I may briefly state :—That every trunk-segment is capable of producing limb-elements; that is to say, of contributing to the formation of median and paired fins. The shifting of a fin up or down the body is not due to the migration of fin-material from one place to another in the course of ontogeny; the fin, as a whole, arises from that region of the trunk which it occupies in the adult (as is shown by the development and the nerve-supply). Relative displacement in ontogeny is due almost entirely to "concentration," a relative narrowing of the base of the fin. Change of position in phylogeny is brought about by progressive reduction on one side, and growth on the other; apparent migration is due to certain segments beginning to contribute to the fin at one end and certain other segments ceasing to contribute at the other. By such "transposition" the fin may reach an entirely new position.

Now, in the case of the fins of fishes, I have already shown (5) that it is not possible to account for variation in position by the theory of inter- and excalation. Growth and transposition from one segment to another alone account for the facts. The same is probably true of the occipital condyle. There is not the slightest trace of the disappearance of segments behind the vagus in the ontogeny of the Amphibia. We are familiar with the variation in the extent of the gill-region in Vertebrates by mere growth. Obviously the hind limit of the series of gill-slits varies backward or forward, according as certain segments cease to develop gills or take on the function of gill-formation. The posterior limit of the skull is doubtless altered in the same way, and the position of the occipital condyles may shift up or down the segmental series. There should, therefore, be no theoretical objection to accepting the anatomical and embryological evidence that the occipital region of the head in Amphibia contains only three segments. If segments could really disappear, leaving no trace behind, it would be hopeless to attempt to homologise segments in any two forms.

There is another theoretical consideration which seems to have led to the adoption of the view that the occipital region of the Amphibia is not as simple as it appears. It is urged that if it contained only three segments, the Amphibia would be more primitive than the Fishes from which they have descended. The possibility of the reduction in the number of occipital segments has just been explained above; but is there really any necessity to assume that it has taken place? From whatever Fishes the Amphibia may have been derived, we may be sure it was not from fully specialised Selachians. From palæontology alone we may hope to obtain definite evidence on this point; until contrary evidence is brought forward, there is no necessity to assume that the ancestors of the Amphibia had more than three differentiated occipital segments. Of all the living fishes the Dipnoi are those which most closely approach the Amphibia; even in the modern *Ceratodus* there is no occipital condyle, no distinct limit between head and trunk. It is true that several trunk-segments have here been more or less completely assimilated to the skull (Sewertzoff, **10**); but there is no reason to believe that in the remote common ancestor of the Dipnoi and Amphibia the dividing-limit between the two regions could not have been developed three segments behind the auditory capsule. This seems to be in agreement with the conclusions of Agar (**1**), based on a study of the development of *Lepidosiren* and *Protopterus* *.

The hypoglossus in the Amphibia and Amniota may certainly be considered as homologous, although not necessarily composed of the same segmental nerves. It is owing to the shortness of the skull in the Amphibian that the hypoglossal roots come out behind it.

Summary.

The chief contents of this paper may be summarised as follows. Three occipital segments occur in the head of *Amblystoma*. Of the three somites developed in these, the first forms no muscle and disappears early; the second forms a myotome divided into dorsal and ventral portions, of which the former alone persists, fusing with the myotome next behind. The myotome of the third segment persists dorsally, that of the first trunk-segment

* The occipital region in fossil Amphibia seems to have been formed as in the modern species. Important evidence as to the assimilation of the hypoglossal segments in primitive Amniotes may perhaps be gleaned from a careful investigation of early fossil Reptiles. For instance, it seems to me not improbable that in *Pareiasaurus* the occipital region is still in an intermediate condition.

combines with it to form the temporal longitudinal muscle supplied in the adult by the first spinal nerve. The glossopharyngeal nerve belongs to the first metaotic segment and has no ventral root. To the second segment belongs the vagus root, with which seems to be combined the ganglia of the next two nerves. No ventral root was found in the second segment; but a ventral root occurs in the last metaotic segment in early stages of development. The first spinal issues from between the skull and first neural arch as a ventral root only; it joins the second spinal to form the hypoglossal nerve supplying muscles derived from ventral outgrowths of the second, third, and fourth myotomes. The basilar plate of the skull is formed by a backward growth of the trabeculæ meeting a forward growth of the base of the occipital arches. It fuses with the auditory capsules, and with the præoccipital arches developed in the septum between the first and second myotomes. The occipital arches arise in the septum between the second and third myotomes. There is no evidence of the disappearance of segments behind the vagus, and no valid objection to the view that the hind limit of the skull may shift backwards or forwards in the course of phylogeny. At the same time there is no reason to suppose that the ancestors of the Amphibia had more than three occipital segments, when the occipital condyle became clearly defined.

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Explanation of Lettering on Text-figures.

a., auditory nerve.
ac., auditory capsule.
acp., ascending process of quadrate.
as., auditory sac.
bp., branchial plexus.
br., branchial branch of vagus.
brn., brain.
brs., mesoblast of branchial arches 1–4.
brsl., branchial slit 1–4.
cmm., median mandibular cutaneous branch of facial.
col., columella auris.
ctr., crista trabeculæ.
e., eye.
et., epiblastic thickening.
f., facial nerve.
fac., floor of auditory capsule.
foc., oculomotor foramen.
fop., optic foramen.
gf., facial ganglion and its epiblastic thickening.
ggl., ganglion of glossopharyngeal.
gl., glossopharyngeal nerve and its epiblastic thickening.
gt., glottis.
gtr., ganglion of trigeminal and its epiblastic thickening.
gv., ganglion of vagus and its epiblastic thickening.
h., hyomandibular branch of facial.
hda., hyoid arch.
hyp., hypoglossal nerve.
hypm., hypoglossal muscle.
im., internal mandibular branch of trigeminal.
j., anastomosis of Jacobson.
ll., lateral line nerve.
m., medulla.
ma., mandibular arch.
md., mandibular branch of trigeminal.
mds., mesoblast of mandibular arch.
mt., myotome 1–6.
mth., mouth.
mx., maxillary branch of trigeminal.
na. 1, neural arch.
nch., notochord.
ns., nasal sac.
oc., occipital arch.
ocp., optic cup.
opn., optic nerve.
per., pericardium.
poc., preoccipital arch.
pop., preorbital process.
prf., profundus nerve.
prn., pronephros.
q., quadrate.
s. 1, 2, ..., metaotic somite.
sh., hyomandibular somite.
sk., hind limit of skull.
sm., mandibular somite.
sop., superior ophthalmic nerve.
*sp.*1. first spinal nerve.
*sp.*2 d & v, second spinal nerve, dorsal and ventral root.
spg., spinal ganglion.
spl., spiracular slit.
spvr., ventral root of spinal nerve.
tr., trabecula cranii.
trg., trigeminal ganglion.
trp., trabecular parachordal.
tso., tectum synoticum.
v., vagus nerve.
vll., ventral lateral line nerve.
vr., roots of vagus and glossopharyngeal.
vrt., ventral root.

9. The Mammals of the Tenth Edition of Linnæus; an Attempt to fix the Types of the Genera and the exact Bases and Localities of the Species. By OLDFIELD THOMAS, F.R.S., F.Z.S.

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The tenth edition of Linné's 'Systema Naturæ' is the recognized basis and commencement of all systematic zoological work, but doubtful questions in its interpretation are very numerous, and there is probably nothing more desired, by mammalogists at least, than a methodical examination of this important work, with suggestions, obtained on some definite and uniform system, for the identification of its types, both of genera and species.

For many years I have taken a very great interest in this subject, and have now ventured to prepare the present paper, with the hope that it may be of service to other mammalogists less favourably situated as regards books and specimens than I have